

A TAXONOMIC REVISION OF *CONDYLOCARPON* (APOCYNACEAE)¹

MARY E. FALLEN²

ABSTRACT

Condylocarpon, which has a center of distribution in Brazil and the Guianas, has been infrequently collected and thus is not well known. Here the number of species is reduced from 17 to 7, and the new combination *Condylocarpon intermedium* Muell.-Arg. subsp. *laxum* (Muell.-Arg.) Fallen is made. Peculiar petal appendages, fruit type, and the shape of the style-head are shown to be important taxonomic characters that can be used to define two basic groups within the genus.

TAXONOMIC HISTORY

Condylocarpon is a small neotropical genus of Apocynaceae occurring in disjunct habitats from Nicaragua to Brazil. Five of the species are endemic to Amazonian Brazil, the Guianas, and adjacent regions, suggesting an Amazonian origin for the genus. Although some of the species are geographically wide-ranging, all tend to be ecologically restricted to special life zones. Most are members of the lowland wet or moist forest community. One occurs in the more xeric cerrado community; another, the only species of *Condylocarpon* to occur outside continental South America, has fruits that show adaptations for salt water dispersal, and therefore occurs also in coastal habitats. All species are woody forest lianas with small, inconspicuous flowers and dry, indehiscent fruits. *Condylocarpon* is found mostly in lowland forest. According to label information for the specimens that I have seen, more than 80 percent were growing along river banks. Although this may be an artifact of the intensive collecting along rivers that are important transportation routes, it suggests that these indehiscent fruits may be broken apart and dispersed by water. Trends of diversification are illustrated by elaboration of the corolla lobes and modifications of the articulated fruit. Due to their narrow ecological habitats, most species have been collected only rarely. The last comprehensive treatment was by Mueller-Argovius (1860), who recognized 11 species. Six of these species are maintained here and one is treated as a subspecies. Of the six species that have been described since 1860, five are reduced to synonymy.

Condylocarpon was validly published by Desfontaines (1822), who described the species *C. guyanense* based on a fruiting specimen sent to him by Joseph Martin, director of the Jardin de Botanique de Cayenne, French Guiana. The description is quite accurate with the exception of his interpretation of the areolate tertiary venation on the lower leaf surface as groups of scales.

In the *Prodromus*, DeCandolle (1844) recognized two species of *Condylocarpon*. In addition to *C. guyanense*, he correctly assigned *Echites isthmica* (Vellozo, 1829) to *Condylocarpon* and made the new combination. He also described *Maycockia*, honoring Dr. James Maycock, a physician and naturalist, who in the early part of the 19th century compiled a catalogue of the plants in Barbados. The type of the new genus, *M. rauwolfiae*, is synonymous with *Condylocarpon isthmicum*. Because Vellozo's type specimens were lost, the type for *Condylocarpon isthmicum* is the plate of *Echites isthmica*, which appeared in Vellozo's (1829) *Flora Fluminensis*, the poor quality of which was noted by DeCandolle (1844) in the new combination, as well as by Mueller-Argovius in his later treatment of the group in Martius' *Flora Brasiliensis* (1860). Although the plate of *Echites isthmica* includes flowers as well as fruits, the flowers are so ambiguously depicted that little more can be discerned than that the corolla is 5-parted. The type, therefore, must be considered functionally as a fruiting specimen. Thus at the time DeCandolle described the genus *Maycockia*, the only two species known to belong to the genus *Condylo-*

¹ Supported by a Fulbright/Swiss Universities Grant. I thank the staff of the Institut für Systematische Botanik-Zürich for their assistance, and in particular, I thank Professors Friedrich Markgraf and Peter Endress, for their constant support and guidance.

² Institut für Systematische Botanik der Universität Zürich, Zollikerstrasse 107, 8008 Zürich, Switzerland. Present address: Institut für Allgemeine Botanik, Ohnhörstrasse 18, D-2000 Hamburg 52, Federal Republic of Germany.

carpon—*C. guyanense* and *C. isthmicum*—were known only from fruiting specimens. Since the type of *Maycockia* was based on a flowering specimen, it is understandable that DeCandolle failed to recognize the two genera as synonymous.

In 1851, Miquel published the description of an apocynaceous liana collected in Suriname as the type of a new genus. He noted that it was a peculiar genus showing affinities to *Tabernaemontana* and *Ochrosia* and he named it after Nicolas Hortsman, an early explorer in the Guianas and Pará, Brazil. *Hortsmania* is synonymous with *Condylocarpon*. It is possible that Miquel failed to recognize this specimen as belonging to the genus *Condylocarpon* due to the unusual fruit development of this species, in which only one of the paired carpels develops, with only the lowermost seed in that carpel maturing, so that instead of the usual paired, multi-articulate fruits, which are characteristic for most species in the genus, *C. myrtifolium* has a solitary, single-seeded fruit.

Mueller-Argoviensis' monograph of the genus (1860) appeared in his treatment of the Apocynaceae in Martius' *Flora Brasiliensis*. He was the first to connect *Maycockia* and *Hortsmania* with *Condylocarpon* and make the reassignments. In addition he described seven new species from specimens collected in Brazil by such well-known collectors as Schott, Riedel, Spruce, and Sellow.

Rhipidia is also synonymous with *Condylocarpon*. Described by Markgraf in 1926 from a fruiting specimen collected in Pará, as *Anechites* (?) *amazonica*, it was raised by him to generic rank when he received flowering material in 1930. Markgraf realized that there was a close affinity between *Rhipidia* and *Condylocarpon*, but he recognized the former as distinct on the basis of its short corolla lobes, high placement of the stamens on the corolla tube, ovarian disc, and hairy, filiform fruit. *Rhipidia* was reduced to synonymy under *Condylocarpon* by Ducke (1943), who at that time described two new Amazonian species of *Condylocarpon*, *C. hirtellum* (= *C. pubiflorum*) and *C. reticulatum* (= *C. amazonicum*).

GENERIC RELATIONSHIPS

There is, unfortunately, no standard intrafamilial classification system for the Apocynaceae. Schumann's treatment of the family in Engler and Prantl's "Die natürlichen Pflanzenfamilien" (1897), and the studies put forward in a number of papers by Pichon (1948a, 1948b, 1951) are

the most recent comprehensive studies of the family.

Condylocarpon is a member of the large, heterogeneous subfamily Plumerioideae by virtue of its completely fertile, basally unappendaged anthers, which are not adherent to the style-head. Following Schumann, the apocarpous, bifid fruit of *Condylocarpon* put it in the tribe Plumerieae. He splits the Plumerieae into four subtribes: Alstoniinae, Tabernaemontaninae, Rauwolfiinae, and Cerberinae, based, in part, on number of seeds per carpel.

Segregation based on 2, 4, or 6 seeds per carpel (Rauwolfiinae and Cerberinae) versus many seeds per carpel (Alstoniinae and Tabernaemontaninae) is problematic. Markgraf (1930) criticized Schumann's placement of the "typically few-seeded" *Condylocarpon* in the Alstoniinae. He felt that *Rhipidia* (= *C. amazonicum*) showed affinity to *Anechites* by the ovarian disc and the structure of the fruit, and that these two genera, together with *Condylocarpon*, formed a natural group within the Rauwolfiinae. However, *Condylocarpon* shows a fourfold variation in the number of ovules per carpel. Therefore, Schumann's system is not useful for the classification of *Condylocarpon* beyond tribal rank.

In his classification of the Plumerioideae, Pichon (1948b) split the subfamily into seven tribes, based, for the most part, on whether the fruits were dehiscent or indehiscent, and dry or fleshy. He maintained *Rhipidia* and *Condylocarpon* as separate genera within his tribe Rauwolfiinae, due to differences of the "disc" of *Rhipidia*, and in their fruit structure (apparently not having seen Ducke's (1943) publication). Together these two genera comprise his subtribe Condylocarpaceae, which he notes as having problematic affinities.

I agree with Pichon that *Condylocarpon* is a member of the Rauwolfiinae. However, I do not support his system beyond tribal rank. His subtribes are often too narrowly circumscribed and suggest insufficient study. I feel that it is premature at this time to assign subtribes within the Rauwolfiinae. A more in-depth study of the taxa involved is necessary in order to recognize and evaluate phylogenetic relationships within the tribe. I disagree with Markgraf (1930) that *Condylocarpon* and *Anechites* are closely related. My studies of *Condylocarpon* have failed to reveal the disc that he describes. In *Anechites*, on the other hand, the disc is well-developed and distinct from the ovary. The resemblance of the

fruits of *Condylocarpon amazonicum* to those of *Anechites* is probably best explained by convergence. Both genera are forest lianas with indehiscent fruits, and it is logical that a light, one-seeded mericarp covered with hairs has evolved independently in both genera as an aid to dispersal.

The structure and differentiation of the style-head is an extremely valuable taxonomic character in the Apocynaceae (Schick, 1980; Fallen, 1983). The style-head has, for the most part, been relatively little affected by habitat conditions, and, together with the structure of the anthers, it provides one of the most reliable means of recognizing natural groupings of taxa. The style-head of *Condylocarpon* is unusually simple and undifferentiated. This type of style-head, the indehiscent fruits, and the longitudinally folded seeds suggests a close relationship with *Alyxia*, a paleotropical genus of about 120 species, and to a somewhat lesser extent, with the pantropical genus *Rauvolfia*.

MORPHOLOGY

Leaves

Of the seven species of *Condylocarpon* recognized in this treatment, two (*C. guyanense* and *C. isthmicum*) have three leaves per node; the other species all have opposite leaves. With the exception of *C. myrtifolium*, which has extremely consistent leaf characteristics, the leaves tend to show considerable variability within a species in both their size and shape. The leaves of all species are entire and glabrous to subglabrous adaxially. The abaxial surface is glabrous in *C. glabrum*, *C. guyanense*, and *C. myrtifolium*, and pilose only along the midvein in *C. intermedium*. The nature of the adaxial surface in the other three species shows a wide range of interspecific variability. Therefore, leaf characteristics seem to be of relatively little taxonomic value, although they have frequently been employed in specific and particularly supraspecific delimitations in earlier treatments. The more adequate herbarium material now available provides a better perspective of the range of variability within the genus.

Inflorescence

The inflorescence in *Condylocarpon* is a many-flowered thyrses. These thyrses may be terminal only or terminal and axillary. They often exhibit

a congested growth that makes them appear cyme- or even umbellike (Fig. 1).

Flowers

The calyx of *Condylocarpon* is regular, pentamerous, and without squamellae on the adaxial surface of the sepals.

Aestivation is sinistrorse and the corolla is globose in bud in most species. The latter aspect may be partly due to the bulk of the inwardly rolled appendages of the corolla lobes. Although the corollas of all species are less than 1 cm in diameter, they exhibit variety in form as well as in relative size. A very useful character for specific delimitations within the genus is the structure of the corolla lobes. In some species (i.e., *C. glabrum*, *C. guyanense*, *C. intermedium*, and *C. isthmicum*) the corolla lobes are equipped with lorate appendages that are speckled or streaked with reddish brown to red-violet markings on the abaxial surface. The corollas of these species may be up to 7 mm across, but greater than half of this distance is accounted for by the appendages themselves; the diameter without the appendages is no more than 2.0–2.5 mm (Fig. 2A). The corolla lobes of the other species lack lorate appendages. In *C. myrtifolium* they are shortly auriculate and ascending. This is the smallest-flowered species, with corollas about 3.5 mm in diameter, including their short, acuminate petal tips (Fig. 2B). The corolla lobes of *C. amazonicum* and *C. pubiflorum* are oblique and spreading to slightly ascending. The corollas of *C. pubiflorum*, 9 mm in diameter, are the largest in the genus (Fig. 2C).

The stamens of *Condylocarpon* have filaments about 0.2 mm long and are inserted midway or slightly above in the corolla tube. The anthers are ovate to lanceolate and range from 0.3 to 0.5 mm in length. The thecae are fertile completely to the base. The anthers are without sterile basal appendages and are not adherent to the style-head.

The style-head of *Condylocarpon* is one of the least specialized that occurs within the Apocynaceae. It is orbicular in most species (Fig. 2D), but turbinate in *C. amazonicum* and *C. pubiflorum* (Fig. 2E), and has two free apical appendages. It is covered with secretory papillae and shows no regional differentiation of the epidermal cells (Fig. 3). The style elongates very little during development, so that at anthesis the style-head is sessile or with a style no more than

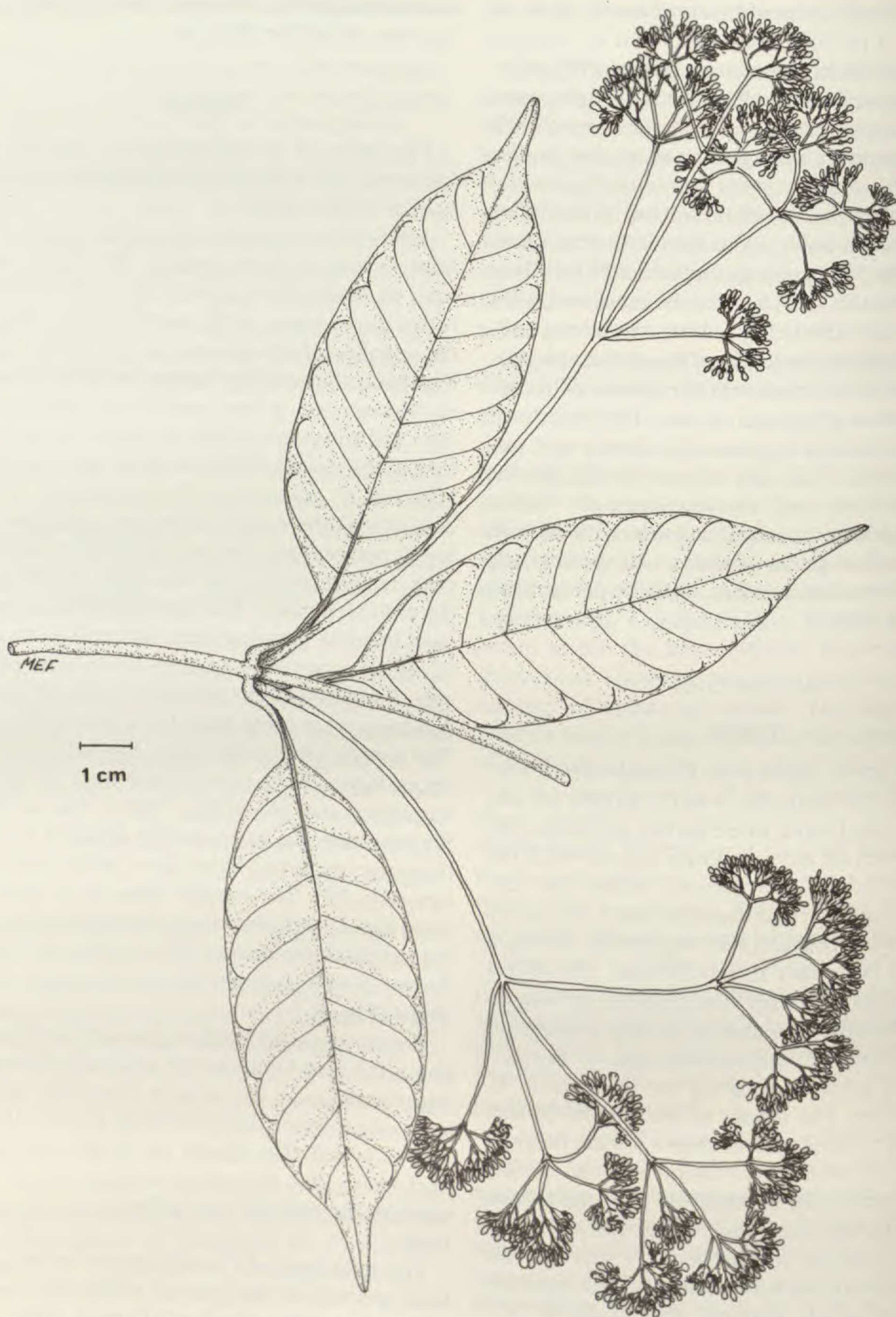


FIGURE 1. *Condyllocarpon guyanense*.

0.4 mm long. The gynoecium is apocarpous, being composed of two carpels that are united at their apices by the common style-head. The ovary is conical, glabrous, and ranges from 0.3 to 0.8 mm in height.

Condyllocarpon has usually been described as lacking nectaries or a disc (Miquel, 1851; Mueller-Argoviensis, 1860; Miers, 1878). However, Markgraf (1930) described *Rhipidia* (= *Condyllocarpon amazonicum*) as having a disc, and used

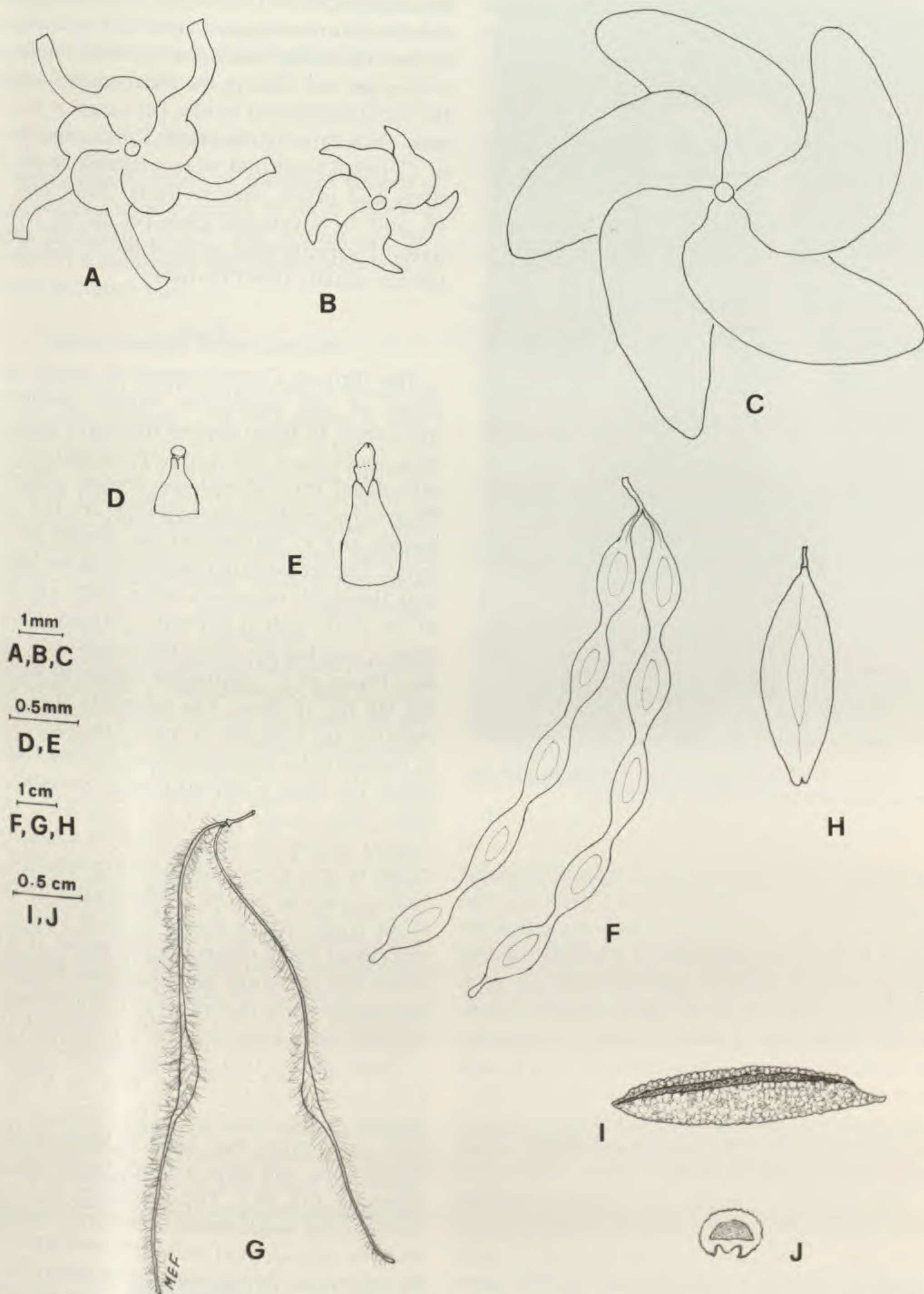


FIGURE 2. Basic structural types of *Condylocarpon*. A–C, corolla: A, *C. isthmicum*; B, *C. myrtifolium*; C, *C. pubiflorum*. D–E, style-head: D, *C. guyanense*; E, *C. amazonicum*. F–H, fruit: F, *C. isthmicum*; G, *C. amazonicum*; H, *C. myrtifolium*. I–J, seed, *C. pubiflorum*: I, from the side; J, in transverse section.



FIGURE 3. Scanning electron micrograph of the gynoecium of *Condyllocarpon guyanense*.

this as one of the criteria to distinguish *Rhipidia* from *Condyllocarpon*. Ducke's (1943) description of *C. reticulatum* included a disc. He stated at the end of the description that the study of the ovary of dried material was very difficult, and that the data used in the diagnosis were provided by Dr. Kuhlmann. I have studied the gynoecia of all species in serial sections and have found no distinct disc. Nectar seems to be secreted from the ovary wall. Markgraf's and Ducke's mistake may be due to the lobed appearance of the ovary base in desiccated material.

The number of ovules per carpel is usually four, with the ovules arranged biserially (*C. amazonicum*, *C. glabrum*, *C. guyanense*, and *C. myrtifolium*). In both *C. amazonicum* and *C. myrtifolium* all but one of the ovules in each carpel degenerate during development, resulting in a single-seeded carpel at maturity. In *C. myrtifolium* one of the carpels degenerates as well. Both *C. intermedium* and *C. isthmicum* usually have five or six ovules per carpel, and the specimens that I have examined usually had four or five

seeds in each mature carpel. The ovules of *C. pubiflorum* are arranged in four or five rows rather than biserially, and have a greater number of ovules per row than in the other species, so that the usual number of ovules per carpel is ca. sixteen. Only three of the fifteen fruiting specimens of *C. pubiflorum* that were available to me for study had intact, mature fruits. These had 12, 15, and 16 developed seeds per carpel, respectively; I surmise that most of the ovules in this species usually reach maturity.

Fruit

The fruit of *Condyllocarpon* is usually composed of two pendulous, woody, indehiscent mericarps. In those species that have lorate corolla appendages, the mericarps are glabrous and articulated into several one-seeded, somewhat flattened or angled segments (Fig. 2F). In *C. guyanense* and *C. isthmicum* the carpels are flattened. The seed-containing segments are broader than the sterile regions between them. The tissue of the ovary wall at maturity contains many air spaces, making the fruits lightweight and buoyant. Fruits of *C. isthmicum* remained afloat in the lab for 16 days. The segments of *C. intermedium* are 3-angled in transverse section, and at maturity the seed-containing segments are inflated, the inner ovary wall being composed of a light, corky tissue about 3–4 mm thick. In the regions linking the seed-containing segments the carpel is only a few millimeters in diameter and lacks a corky layer. The breaking up of the carpel at the constrictions would result in four or five individual corky diaspores per carpel. It is proposed that the corky layer has been selected for as a protection to the embryo in conjunction with the shift to salt water dispersal (cf. Stebbins, 1971).

Those species that lack appendages on the corolla lobes have mericarps that are terete and covered by an indument. The paired mericarps of *C. pubiflorum* may have as many as 16 segments each, and have a short, tomentose indumentum (Fig. 9C). The mericarps of *C. amazonicum* are single-seeded, fusiform, tapering to filiform extensions at both ends, and are covered by velutinous, ferruginous-brown hairs (Fig. 2G). An exception is *C. myrtifolium*. In this species the corolla lobes lack appendages, but the fruit is glabrous and flattened, and degeneration during development results in a one-carpellate, single-seeded fruit at maturity (Fig. 2H).

The seeds are fusiform, longitudinally folded, and measure from 8.0 to 10.0 mm in length. The

testa is verrucose (Fig. 2I, J). The embryo is straight; the cotyledons are narrowly elliptic and constitute slightly more than half of the entire length of the embryo.

Pollen

Condylocarpon is one of the eight genera of Apocynaceae that are known to have pollen in tetrads (Erdtman, 1952). The tetrads are surrounded by a substance that stains deep blue in safranin and astra blue.

INFRAGENERIC RELATIONSHIPS

The species of *Condylocarpon* can be separated into two basic groups. The first group is characterized by having the left margin of the corolla lobe elaborated into a lorate appendage with reddish brown markings on its abaxial surface. All of the species in this group have a simple orbicular style-head and glabrous, distinctly flattened or angled, articulated fruits. This is the larger group and includes *C. glabrum*, *C. guyanense*, *C. intermedium*, and *C. isthmicum*.

The second group is comprised of the two Amazonian endemics, *C. amazonicum* and *C. pubiflorum*. In this group the corolla lobes are auriculate or oblique and lack lorate appendages, and the style-head is turbinate. The fruits are covered by an indumentum and the segments are terete. It may seem that the single-seeded mericarps of *C. amazonicum* show little resemblance to the many-seeded mericarps of *C. pubiflorum*, but the similarity of their floral structure indicates a very close relationship between these two species, and at the same time distinguishes them from all other species in the genus.

Condylocarpon myrtifolium shows characteristics of both groups. The corolla lobes lack lorate appendages; they are auriculate and most closely resemble those of *C. amazonicum*. Although the style is relatively long, the style-head is simple and orbicular. One mericarp aborts during development, so that the fruit is a single, one-seeded mericarp composed of one glabrous, flattened segment.

METHODS

Morphological studies were done with the aid of a Wild stereoscope and a Wild microscope, both with drawing-mirror attachments for illustrations.

Only dried herbarium specimens were available for study. Material to be studied in serial

sections was first boiled for 3–4 minutes, to restore pliability and form, and then put into a dilute KOH solution and kept at 62°C for 1 hour. To remove the KOH the material was then placed in water and kept at 62°C at least 4 hours; this step was repeated. Specimens were then dehydrated in an alcohol-xylol series, embedded in paraplast, cut with a rotatory microtome at 10 micrometers, and stained with safranin and astra blue.

Specimens for study were provided on loan by the following herbaria: A, BM, BR, CAY, F, FI, G, GH, GOET, K, M, MO, NY, P, RB, S, U, UC, US, W, and Z. Unless otherwise stated, all type specimens were seen.

TAXONOMIC TREATMENT

Condylocarpon Desf. Mém. Mus. Hist. Nat. 8: 119. 1822. TYPE: *C. guyanense* Desf.

Maycockia A. DC., Prod. 8: 380. 1844. TYPE: *M. rauwolfiae* A. DC. = *Condylocarpon rauwolfiae* (A. DC.) Muell.-Arg. = *Echites isthmica* Vell. = *Condylocarpon isthmicum* (Vell.) A. DC.

Hortsmannia Miq., Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem ser. 2, 7: 167. TYPE: *H. myrtifolia* Miq. = *Condylocarpon myrtifolium* (Miq.) Muell.-Arg.

Rhipidia Mgf., Notizbl. Bot. Gart. Dahlem 10: 1033. TYPE: *Anechites* (?) *amazonica* Mgf. = *Condylocarpon amazonicum* (Mgf.) Ducke.

Woody *lianas* with slender, lenticellate twigs with copious, milky latex. *Leaves* entire, membranous to subcoriaceous, decussate or verticillate, glabrous to subglabrous on the upper surface, glabrous to tomentose on the lower surface; petioles glabrous or with an indumentum. *Inflorescence* a many-flowered thyrs, becoming congested in the terminal branchlets; bracteoles small, ovate to triangular, glabrous to tomentose, usually ciliate. *Flowers* 2.5–5.0 mm long; calyx 5-lobed, the lobes obtuse to triangular, ciliate, often hyaline, inner surface without glands; corolla white, yellow or orange, funnelform or salverform, often globose in bud, aestivation sinistorse, lobes oblique or with red-brown streaked, lorate appendages on the left margin; stamens 5, lanceolate to ovate, without sterile basal appendages and not adherent to the style-head, inserted near mid-tube or above, filaments short; ovary apocarpous, bicarpellate; style short; style-head orbicular, or turbinate, shortly bilobed at the apex. *Fruit* bifid, glabrous or with an indumentum, articulated into several one-seeded, indehiscent segments (in *C. myrtifolium*, reduced by degeneration during development to a soli-

tary, one-seeded segment), or filiform and not conspicuously articulated, and with only a single seed developing per carpel; seed 8.0–10.0 mm long, fusiform, longitudinally folded, testa verrucose; embryo straight, cotyledons narrowly elliptic. *Pollen* in tetrads.

Distribution: *Condylocarpon* comprises 7 species that occur principally in Brazil and the Guianas, with one species reaching Central America.

KEY TO THE SPECIES OF *CONDYLOCARPON*

- 1a. Corolla lobes with red-brown markings and lorate appendages; fruiting carpels distinctly articulated, flattened or angled in transverse section, glabrous; leaves opposite or verticillate.
 - 2a. Leaves 3 (occasionally 4) per node.
 - 3a. Markings not on petal appendages, but pale markings on petals; leaves glabrous on both surfaces; secondary veins 9–11 pairs 3. *C. guyanense*
 - 3b. Markings mostly restricted to petal appendages; lower surface of leaves with patches of pubescence in axils of secondary veins, or tomentose; secondary veins 6–9 pairs 5. *C. isthmicum*
 - 2b. Leaves opposite.
 - 4a. Corolla tube darker from base to level of stamen insertion; lower surface of leaves sparsely pilose along the midvein; secondary veins often difficult to distinguish from inter-secondary veins 4. *C. intermedium*
 - 4b. Corolla tube not darker at the base; leaves glabrous on both surfaces, without inter-secondary veins 2. *C. glabrum*
- 1b. Corolla lobes with neither red-brown markings nor lorate appendages; fruiting carpels terete and with an indumentum or, if glabrous, then fruit consisting of a single one-seeded mericarp; leaves opposite.
 - 5a. Fruit comprised of two carpels, with an indumentum; leaves sparsely to densely tomentose beneath; branches with a slight to dense golden-brown indumentum.
 - 6a. Petioles 2.0–6.0 mm long; flowers 4.0–5.0 mm long, corolla lobes 2.0–5.0 mm long, ovules arranged in four or five rows; fruit articulated into several one-seeded, indehiscent, pubescent segments 7. *C. pubiflorum*
 - 6b. Petioles 0.5–1.0 mm long; flowers 3.5–4.0 mm long, corolla lobes 1.0–1.8 mm long, ovules arranged biserially; fruit with only one seed developing per carpel, covered by long, spreading ferruginous-brown hairs 1. *C. amazonicum*
 - 5b. Fruit consisting of one flattened, one-

seeded, glabrous carpel; leaves entirely glabrous; branches glabrous or puberulous in younger parts 6. *C. myrtifolium*

1. ***Condylocarpon amazonicum*** (Mgf.) Ducke, Trop. Woods 76: 28. 1943. *Anechites* (?) *amazonica* Mgf., Notizbl. Bot. Gart. Dahlem 9: 960. 1926. *Rhipidia amazonica* (Mgf.) Mgf., Notizbl. Bot. Gart. Dahlem 10: 1033. 1930. TYPE: Brazil, Pará, Villa Braza, Tapajoz, Ducke RB 17480 (fruiting) (RB, lectotype; MO, isoelectotype). The holotype was destroyed at Berlin in 1943; the isotype is here designated as the lectotype.—Fig. 4A–E.

Condylocarpon reticulatum Ducke, Trop. Woods 76: 28. 1943. TYPE: Brazil, Amazonas, Esperança, mouth of Rio Javari, Igarapé, Ducke 1172 (flowering) (MG, holotype; MO, NY, isotypes).

Condylocarpon occidentale Mgf., Bradea 3: 80. 1980. TYPE: Brazil, Amazonas, Porto Velho-Guijará mirim, frontier Brazil-Bolivia, Cordeiro 828 (flowering) (Z, holotype; INPA, isotype, not seen).

High climbing, woody *lianas*; branches terete, reddish brown infused with black, glistening, golden verrucose or lenticellate, subglabrous to golden-brown tomentose. *Leaves* opposite, elliptic to broadly lanceolate, subcoriaceous, 7.0–12.0 cm long, 2.5–5.0 cm broad, acute to shortly acuminate at the apex, obtuse to truncate at the base, the upper surface glabrous to subglabrous, the lower surface subglabrous to densely tomentose; secondary veins 12–15 pairs, prominent on the lower surface; midvein plane to shallowly canaliculate above, prominent below; petioles 0.5–1.0 cm long, shallowly canaliculate, often blackened and glistening, glabrous or with an indumentum. *Inflorescence* terminal and axillary thyrses, puberulous to densely reddish brown tomentose or velutinous; bracteoles lanceolate, acute, puberulous to tomentose. *Flowers* 3.5–4.0 mm long, 2.5–3.0 mm broad; pedicels slender, 0.5–2.0 mm long, subglabrous; calyx subglabrous to tomentose, lobes ovate to triangular, ciliate; corolla greenish white to creamy yellow, salverform, tube 2.0 mm long, 0.5–1.0 mm broad, constricted at the base, with an annular constriction at the throat, lobes 1.0–1.8 mm long, 0.7 mm broad, ascending to spreading, oblique, with neither lorate appendages nor red-brown markings; stamens ovate, inserted above mid-tube; ovary conical, ca. 0.6 mm long; style-head subsessile, turbinate; ovules four per carpel, biserially arranged. *Fruit* bifid, woody, densely velu-

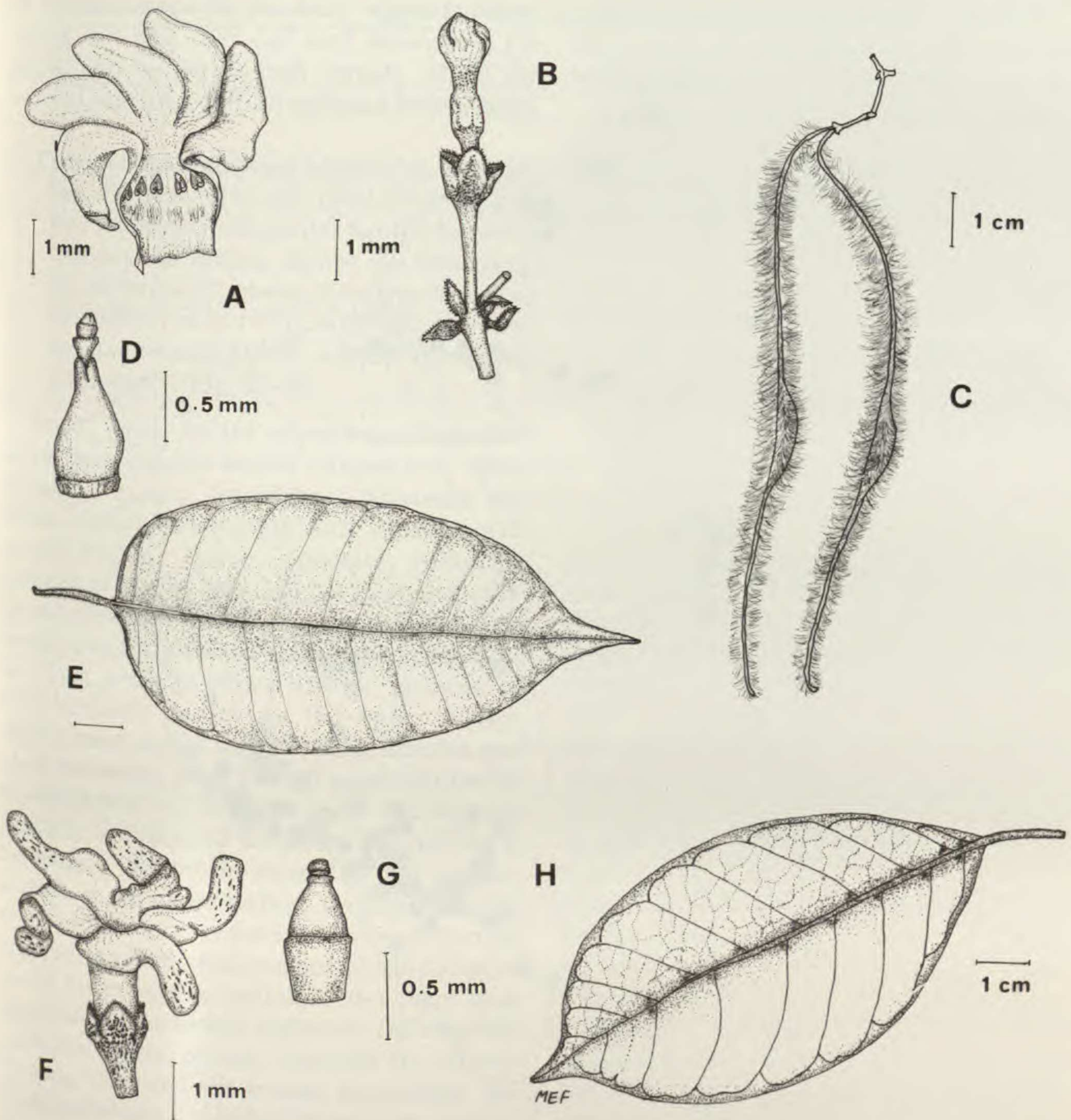


FIGURE 4. A-E, *Condyllocarpon amazonicum*: A, corolla; B, flower in bud; C, fruit; D, gynoecium; E, leaf, upper surface. F-H, *Condyllocarpon glabrum*: F, flower; G, gynoecium; H, leaf, lower surface.

tinous with spreading ferruginous-brown hairs 3.0–5.0 mm long, each carpel 10.5–15.0 cm long, filiform, terete, with only one seed developing per carpel, seed region enlarged, ca. 1.5 cm long, 3.0 mm broad.

Distribution: Secondary and riverine non-inundated forest in central and western Amazonian Brazil and adjacent regions in Venezuela, Suriname, and Bolivia (Fig. 5).

Specimens examined. VENEZUELA, AMAZONAS: Bretelet 4753 (F, M, MO, Z). SURINAME: Heyde & Lindenman 65 (U); 190 (U); Irwin et al. 55022 (K, NY, U).

BRAZIL. AMAZONAS: Chagas 416 (MO); Cid et al. 825 (WAG); 925 (WAG); Ducke 353 (A, F, K, MO, NY, US); 699 (F, MO, NY, US); 974 (K, MO, NY, UC, US); 2344 (NY, Z); RB 21697 (K, P, RB, S, U, US; F, photo of sheet at P); RB 23876 (K, U, US); Krukoff 8007 (A, BR, F, K, MO, NY, U, US); Prance et al. 14230 (F, K, M, NY, S, U, US); 14708 (F, GH, K, U, NY, S, US); Rodrigues & Coelho INPA 7632 (F, MO). ACRE: Forero 6317 (NY, Z). PARÁ: Frões 30423 (MO, US); Oliveira 3610 (NY); Silva 936 (F, NY, Z); 1419 (WAG). RONDÔNIA: Cordeiro 136 (MO); 594 (Z); 828 (Z); Prance et al. 5627 (F, K, NY, U, US, Z). BOLIVIA. PANDO: Rusby 2599 (NY, US).

This species is distinct from all other species



FIGURE 5. Geographical distribution of *Condyllocarpon*. Square = *C. amazonicum*; star = *C. glabrum*; triangle = *C. myrtifolium*; circle = *C. isthmicum*.

of *Condylocarpon* by the fruit, which is bicarpellate, but with only one seed developing per carpel, and by the filiform carpels, which are covered with long, stiff, ferruginous-brown hairs.

2. *Condylocarpon glabrum* Muell.-Arg. in Martius, Fl. Bras. 6(1): 66. 1860. TYPE: Brazil, Rio de Janeiro/Espírito Santo, between Campos and Vitória, *Sellow 304* (flowering) (K, lectotype; F, photo of isotype at B that was destroyed in 1943). A lectotype is chosen here because Muell.-Arg. did not choose a holotype.—Fig. 4F–H.

Woody *lianas* (?); the young branches puberulous, deep reddish brown infused with black, glistening, striate, lenticellate, becoming glabrous, densely lenticellate and streaked with golden-brown. *Leaves* opposite, becoming crowded at branch apex, elliptic to oblong-elliptic, membranous, 9.0–11.0 cm long, 3.0–5.0 cm broad, apex abruptly acuminate with acumen 5.0 mm long, acute to obtuse at base, glabrous on both surfaces, opaque on the upper surface, slightly paler on the lower surface, margins revolute; secondary veins 9 or 10 pairs, without inter-secondary veins, impressed and distinct adaxially, arching and becoming less distinct at the margin, prominent abaxially; midvein impressed on the upper surface, prominent on the lower surface; tertiary venation indistinct on the upper surface, reticulate and polygonally areolate on the lower surface; petioles 1.0–1.7 cm long, canaliculate, blackened, glabrous. *Inflorescence* a terminal thyrse, primary branches lax, 3.0–4.0 cm long, deep reddish brown, lenticellate, minutely puberulous, terminal branchlets congested; bracteoles subglabrous, ovate, acute, densely ciliate, 1.0–1.5 mm long. *Flowers* densely aggregated at the ends of the terminal branchlets, 2.5 mm long, globose in bud, subsessile or with pedicels up to 1.5 mm long; calyx glabrous, tube densely mottled with red-brown markings, lobes pallid, hyaline, broadly orbicular, margins ciliate; corolla pale, glabrous, funnelform, tube ca. 1.5 mm long, 1.0 mm broad, lobes with spreading, lorate petal appendages, ca. 1.0 mm long, 0.6 mm broad, that are densely speckled with deep red-violet to red-brown markings on the abaxial surface; stamens lanceolate, deep red-brown, inserted at mid-tube; ovary conical, bicarpellate, 0.3 mm long; style-head subsessile, round; ovules four per carpel, biserially arranged. *Fruit* unknown.

Distribution: Known only from the type, collected from the Atlantic coastal forest of Brazil, between Campos and Vitória (Fig. 5).

Condylocarpon glabrum shows affinities to *C. intermedium*, but differs by the pallid, broadly orbicular calyx lobes, in not having the lower portion of the corolla tube darkened, and with leaves which lack inter-secondary veins.

3. *Condylocarpon guyanense* Desf., Mém. Mus. Hist. Nat. 8: 119. 1822. TYPE: French Guiana, Cayenne, *Martin s.n.* (fruiting) (FI, holotype; P, isotype; F, NY, photo of isotype at B (destroyed in 1943), P, photo of holotype).—Fig. 6A–D.

Climbing, woody *lianas*; branches terete, reddish brown, lenticellate, at least the younger portions puberulous. *Leaves* three per node, elliptic to oblong-elliptic, membranous to subcoriaceous, 9.0–13.0 cm long, 3.0–4.5 cm broad, subcaudate to narrowly acuminate at apex, with acumen 1.0 cm long, 1.5–2.5 mm broad, acute at the base, glabrous on both surfaces; secondary veins 9–11 pairs, impressed on the upper surface, plane on the lower surface; midvein canaliculate on the upper surface, prominent on the lower surface, often with inter-secondary veins that diverge from the midvein but anastomose with tertiary venation; lower surface conspicuously reticulate with well developed, polygonal areoles with branched veinlets; petioles 1.2–1.8 cm long, canaliculate, puberulous. *Inflorescence* lax terminal and axillary thyrses, with primary branchlets 4.0–9.0 cm long, spreading, puberulous to pubescent; bracteoles ca. 1.0 mm long, acute, puberulous, ciliate. *Flowers* ca. 3.0 mm long, subsessile or with a slender pedicel up to 3.0 mm long; calyx pubescent, lobes ovate, densely ciliate; corolla creamy yellow to orange, salverform, glabrous, tube 1.5 mm long, 0.6–0.8 mm broad, lobes ca. 1.0 mm long, 0.5 mm broad, with lorate appendages, brown markings restricted to bases of lobes; stamens lanceolate, inserted at mid-tube; ovary conical, bicarpellate, 0.5 mm high; style-head orbicular, subsessile, ovules four or five per carpel, biserially arranged. *Fruit* apocarpous, reddish brown, glabrous, composed of two woody carpels, each articulated into as many as five one-seeded, indehiscent segments, each segment 1.5–2.5 cm long, 7.0 mm broad, somewhat flattened, striate, with a longitudinal streak over the seed area.

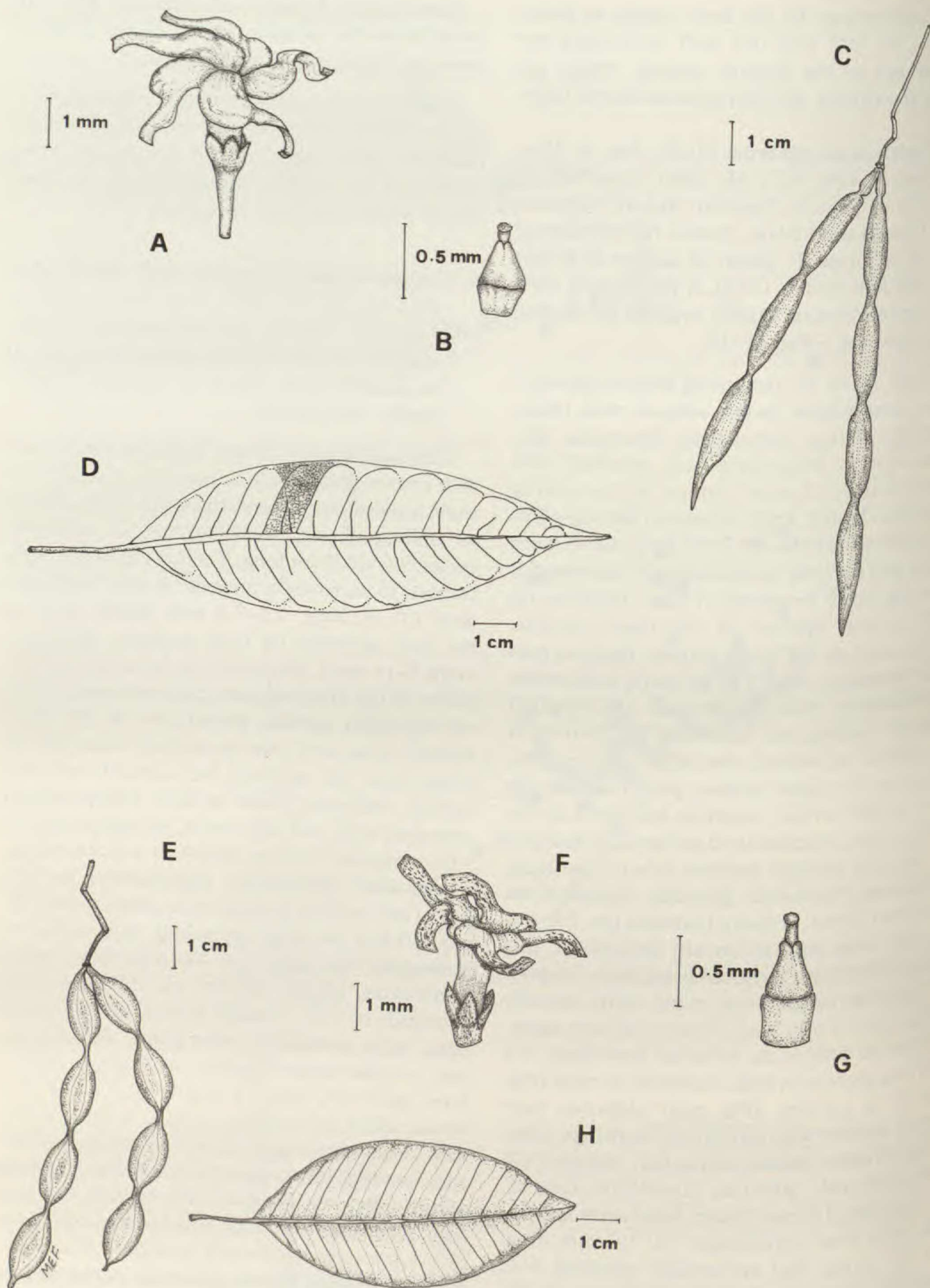


FIGURE 6. A-D, *Condyllocarpon guyanense*: A, flower; B, gynoecium; C, fruit; D, leaf, lower surface. E-H, *Condyllocarpon intermedium* subsp. *intermedium*: E, fruit; F, flower; G, gynoecium; H, leaf, upper surface.

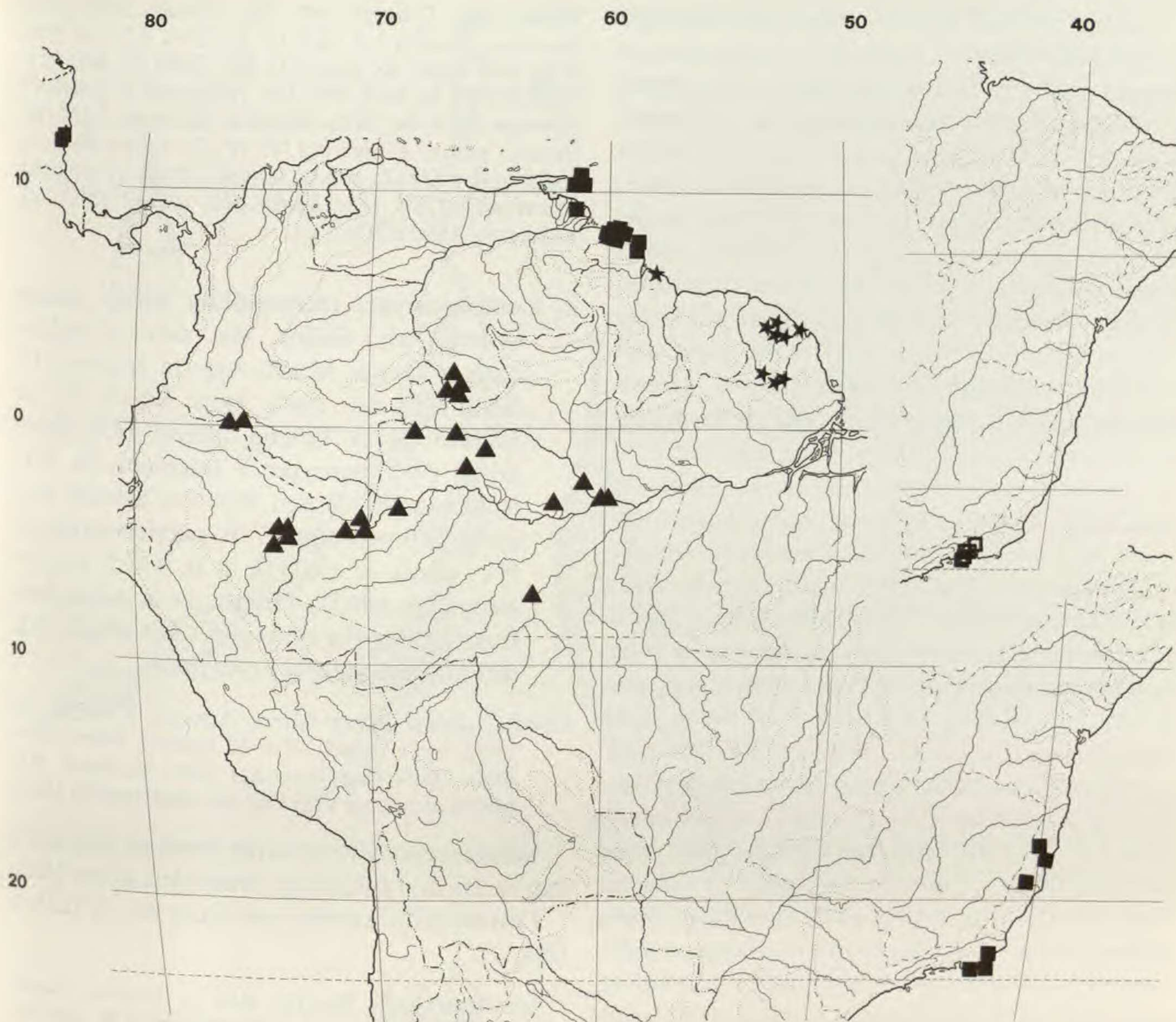


FIGURE 7. Geographical distribution of *Condylocarpon*. Star = *C. guyanense*; black square = *C. intermedium* subsp. *intermedium*; white square = *C. intermedium* subsp. *laxum*; triangle = *C. pubiflorum*.

Distribution: Lowland forest in the Guianas to Terr. Amapá in Brazil (Fig. 7).

Specimens seen. GUYANA. Forest Dept. Br. Gui. 83 (K); Maguire 22890 (MO, NY). FRENCH GUIANA. Lescure 531 (CAY, P); Oldeman 1125 (CAY); Prevost 514 (CAY); Sastre 4701 (MO); Sastre 5470 (CAY); Sastre 5906 (CAY). BRAZIL. TERR. AMAPÁ: Irwin 48275 (F, NY, U, Z); Pires 50683 (NY).

4. *Condylocarpon intermedium* Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860. TYPE: Guyana, banks of Pomaroon River, Schomburgk 785 (flowering) (BM, lectotype; G, K, islectotypes, here designated); Schomburgk 1426 (flowering) (F, NY, photo of syntype at B that was destroyed in 1943).—Fig. 6E–H.

Condylocarpon intermedium var. *brevifolia* Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860. TYPE: Brazil,

Minas Gerais ?, St. Hilaire s.n. (flowering) (P, lectotype; F, islectotype). A lectotype is chosen here, because Muell.-Arg. did not designate a holotype.

Condylocarpon obtusiusculum Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860. TYPE: Brazil, Bahia, Blanchet 1576 (flowering) (G, lectotype here designated). Brazil, without locality, Sellow s.n. (fruiting) (BM, paralectotype). Pro parte quoad plantam syntypicam, non Silva da Manso s.n.

Condylocarpon breviarticulatum Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860. TYPE: Brazil, between Bahia and Vittoria, Sellow 571 (fruiting) (K, lectotype; BM, F, islectotypes, here designated).

Condylocarpon longii Standl. & Wms., Ceiba 3: 34. 1952. TYPE: Nicaragua, Dept. Zelaya, Bluefields, Long 132 (flowering) (ENAG, holotype not seen; F, NY, US, isotypes; F, NY, photo of isotype at US). Nicaragua, Dept. Zelaya, Bluefields, Río Escondido, Molina 1806, 1814 (ENAG paratypes not seen); Nicaragua, along Río Tanten, Molina 2081 (flowering & fruiting) (BM, ENAG not seen, F, paratypes).

Slender, woody *lianas*; branches subverrucose or lenticellate, greyish, glabrous or puberulent in younger portions. *Leaves* opposite, ovate-elliptic to oblong-elliptic, membranous to subcoriaceous, 6.5–10.0 cm long, 2.8–4.5 cm broad, acute to obtuse at apex, obtuse to rounded at base, glabrous on the upper surface, glabrous on the lower surface except along the midvein, which is sparsely pilose; midvein impressed to subcanaliculate on upper surface, prominent on lower surface; secondary veins 9–13 pairs, plane and somewhat indistinct on upper surface, prominent on lower surface, often difficult to distinguish from inter-secondary veins; petioles 0.5–1.5 cm long, puberulous to glabrous, shallowly canaliculate to terete. *Inflorescence* rather lax terminal and axillary thyrses, branchlets puberulous to glabrous; bracteoles ovate to acute, hyaline, ciliate. *Flowers* 2.5–3.0 mm long, 3.5–4.0 mm broad, globose in bud, subsessile or with slender pedicels up to 2.0 mm long; calyx puberulous to glabrous, brown-speckled, lobes ovate to acute, hyaline, ciliate; corolla white, yellow or orange, with a darker region from the base extending to ca. the level of stamen attachment; tube 1.0–1.5 mm long, funnelform, base constricted, throat 1.5 mm broad; lobes 1.0–1.5 mm long, 0.6–0.8 mm broad, with spreading lorate appendages with reddish brown markings on their abaxial surface; stamens lanceolate, inserted at mid-tube; ovary apocarpous, conical; style-head orbicular, subsessile, or with a very short style, ovules five or six per carpel, biserially arranged. *Fruit* glabrous, composed of two woody carpels, each articulated into up to five one-seeded, indehiscent segments, each segment ovoid, 1.0 cm long, 0.7 cm broad, with a corky inner layer ca. 3–4 mm thick.

KEY TO THE SUBSPECIES

- 1a. Inflorescence about the same length as the leaves a. subsp. *intermedium*
 1b. Inflorescence 2–3 times longer than the leaves b. subsp. *laxum*

a. *Condylocarpon intermedium* subsp. *intermedium*.

Inflorescence about the same length as the leaves; branchlets brownish grey.

Distribution: Coastal forests in Nicaragua, Trinidad, Venezuela, Guyana, and in Brazil, from Bahia to Rio de Janeiro (Fig. 7).

Specimens seen. VENEZUELA, DELTA AMACURO: *Steyermark et al.* 114448 (MO, Z). TRINIDAD. *Baker* TRIN

14568 (K); *Crueger s.n.* (K); *Finlay* 2767 (NY). GUYANA. *Beckett s.n.* (K); *De La Cruz* 4117 (F, MO, NY); *For. Dept. Br. Gui.* 315 (K); 5066 (K, MO, NY, U); 5193 (F, K, MO, NY, U); *Hitchcock* 17519 (NY); *Jenman* 6173 (K, NY); *Ward & Kortright* 8729 (K). BRAZIL. BAHIA: *Pinheiro* 2147 (P, Z). ESPÍRITO SANTO: *Kuhlmann* 6411 (Z). RIO DE JANEIRO: *Brade* 11055 (RB); *Martinelli* 4184 (Z); *Mello* RB 49349 (MO, Z); *Schwache* 3100 (GOET).

- b. *Condylocarpon intermedium* subsp. *laxum* (Muell.-Arg.) Fallen, stat. nov.—*Condylocarpon laxum* Muell.-Arg. in Martius, Fl. Bras. 6(1): 66. 1860. TYPE: Brazil, Rio de Janeiro, Serra Tingua, *Schott* 5478 (flowering) (W, lectotype; F fragment, M, NY, isoelectotypes). Brazil, Porto da Estrella, *Riedel s.n.* (flowering) (G, P, paralectotypes; F, NY, photo of syntype at B, which was destroyed in 1943). A lectotype is chosen here from among the syntypes, since Muell.-Arg. did not designate a holotype.

Condylocarpon gracile Miers, Apocyn. S. Amer. 28. 1878. TYPE: Brazil, Rio de Janeiro, *Miers* 4019/8086 (flowering, fruiting) (BM, holotype; NY, photo of isotype at B that was destroyed in 1943).

Inflorescence two to three times as long as the leaves, lax and spreading; branchlets glossy black.

Distribution: known only from Rio de Janeiro (Fig. 7).

Specimens seen. BRAZIL. RIO DE JANEIRO: *Gaudichaud s.n.* (F, NY, photo of specimen at B, since destroyed); *Kuhlmann* 3788 (RB); *RB* 39290 (Z). Without exact locality: *Raddi s.n.* (G).

5. *Condylocarpon isthmicum* (Vell.) A. DC., Prod. 8: 381. 1844.—*Echites isthmica* Vell., Fl. Flum. 3: 112. 1829 (1825), Icones 3: t. 39. 1831 (1827); reprinted in Arq. Mus. Nac. Rio de Janeiro 5: 106. 1881. TYPE: Brazil, Santa Cruz and Pharmacopolitani, illustration in Fl. Flum. Icon. 3: t. 39.—Fig. 8A–D.

Condylocarpon rauwolfiae (A. DC.) Muell.-Arg. in Martius Fl. Bras. 6(1): 64. 1860.—*Maycockia rauwolfiae* A. DC., Prod. 8: 324. TYPE: Brazil, near Rio de Janeiro?, *Lhotsky s.n.* (flowering) (G-DC, holotype; P, isotype; F, NY, photo of holotype).

Condylocarpon rauwolfiae var. *acuminata* Muell.-Arg. in Martius Fl. Bras. 6(1): 64. 1860. TYPE: Brazil, Prov. Minas Gerais, *Widgren* 64 (fruiting) (BR, lectotype; M, P, S, U, isoelectotypes), 192 (flowering) (GOET, P, S, paralectotypes), 1236 (flowering) (BR, paralectotype); *Riedel* 85 (G, M, P, U, paralectotypes); *Langsdorff s.n.* (B, paralectotype, destroyed in 1943). Brazil, Prov. São Paulo, *St. Hilaire* 1227 (flowering) (P, paralectotype); *Sel-*

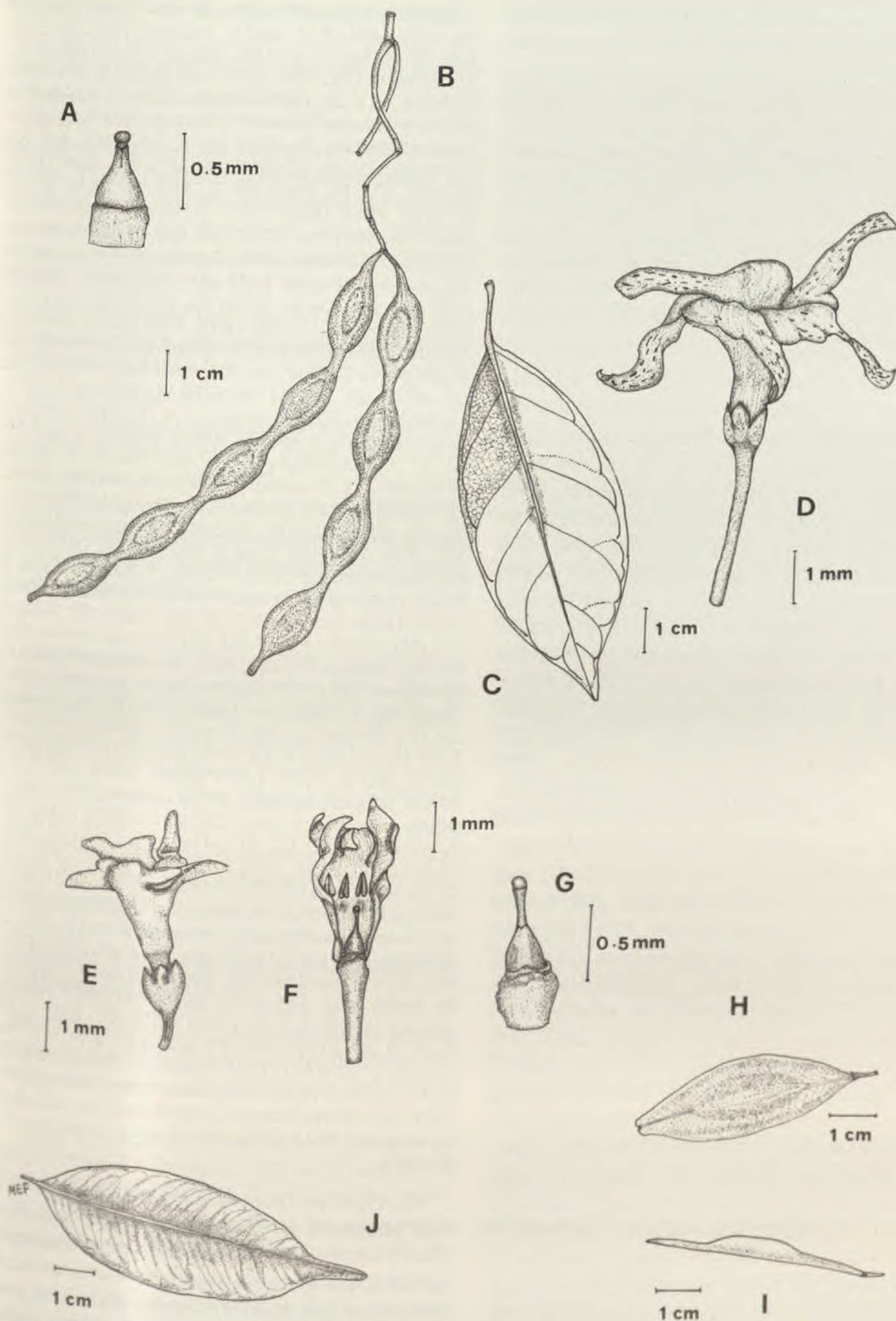


FIGURE 8. A-D, *Condyllocarpon isthmicum*: A, gynoecium; B, fruit; C, leaf, lower surface; D, flower. E-I, *Condyllocarpon myrtifolium*: E, flower, opened; G, gynoecium; H, fruit, top view; I, fruit, side view.

low s.n. (flowering) (BR, K, paralectotypes); *Gaudichaud 366* (flowering) (P, paralectotype), all here designated.

Condyllocarpon rauwolfiae var. *tomentosa* Muell.-Arg. in Martius Fl. Bras. 6(1): 64. 1860. TYPE: Brazil, São Paulo, São Carlos, *Manso da Silva 335* (fruiting) (BR, lectotype); Brazil, Mato Grosso, *Martius s.n.* (fruiting) (M, paralectotype). One of the two syntypes is here chosen as a lectotype, because a holotype was not designated by Muell.-Arg.

Condyllocarpon obtusiusculum Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860. Pro parte quoad plantam syntypicam tantum Brazil, Mato Grosso, Cuiaba, *Manso da Silva s.n.* (flowering) (BR, lectotype, here designated).

Large, woody *lianas*; branches terete, lenticellate, glabrous or pubescent in younger portions. *Leaves* verticillate (mostly three per node), elliptic to ovate-elliptic, membranous to subcoriaceous, 7.0–11.5 cm long, 2.5–4.0 cm broad, acute to acuminate at apex, acute to obtuse at base, upper surface glabrous to subglabrous, lower surface glabrous with patches of pubescence in the axils of the secondary veins or tomentose; secondary veins 6–9 pairs, impressed on the upper surface, prominent on the lower surface; midvein impressed or canaliculate on the upper surface, prominent on the lower surface; tertiary venation well developed on lower surface, reticulate, polygonally areolate with branched veinlets; petioles 0.9–1.5 cm long, glabrous to tomentose. *Inflorescence* a terminal thyrse, branches puberulous to tomentose; bracteoles ovate to triangular, hyaline, ciliate. *Flowers* 3.5 mm long, 6.0–7.0 mm broad, pedicels 1.0–4.0 mm long, glabrous to tomentose; flower buds globose; calyx glabrous to tomentose, tube with red-brown markings, lobes ovate, hyaline, ciliate; corolla cream, yellow, or pale orange, funnelform, tube 1.5–1.8 mm long, throat 1.0–1.5 mm broad, lobes with spreading lorate appendages on the left margin; appendages 2.0–3.0 mm long, 0.5–0.8 mm broad, with reddish brown markings on the abaxial surface; stamens ovate to lanceolate, inserted at mid-tube; ovary apocarpous; style-head orbicular, subsessile; ovules five or six per carpel, biserially arranged. *Fruit* glabrous, pendent, composed of two woody carpels, each articulated into several (usually four or five) one-seeded, indehiscent segments, each segment ellipsoid, 1.5–2.5 cm long, 1.0–1.5 cm broad.

Distribution: Secondary, gallery, and periodically inundated forest and *campos* in the Brazilian Planalto and margins, from Ceará to Argentina (Fig. 5).

Representative collections. BRAZIL. CEARÁ: *Eugenio 980* (RB); *981* (RB). GOIÁS: *Anderson 7822* (NY, Z); *8265* (F, K, MO, NY, RB); *Glaziou 21730* (BR, G, K, P); *Heringer 9915* (Z); *Irwin et al. 18542* (F, NY, US); *31786* (F, NY, Z). DIST. FEDERAL: *Belém & Mendes 24* (NY, U); *Duarte 10185* (Z); *Heringer 9189* (Z); *Irwin et al. 8339* (NY, P); *9539* (F, K, MO, NY, RB, Z); *11141* (F, NY, P); *11420* (F, K, MO, NY, RB); *15357* (F, MO, NY, P); *15657* (F, K, MO, NY, RB); *15913* (F, NY); *Pires 58060* (NY, Z). BAHIA: *Harley et al. 19907* (Z); *Mori et al. 12327* (Z). MINAS GERAIS: *Barreto 914* (F); *5177* (MO, RB); *Davidse & Ramamoorthy 10814* (MO); *Duarte 3538* (Z); *9900* (RB); *Gardner 5074* (K); *Irwin et al. 20764* (K, MO, RB); *27417* (F, NY); *Krieger et al. 10846* (RB); *11373* (RB); *Lindberg 192* (RB); *Magalhães 1226* (MO); *Mexia 4680* (F, G, K, MO, NY, U, Z); *Regnell II-136* (BR, F, GOET, M, NY, P, U, Z); *Roth 1736* (RB); *St. Hilaire 172* (P); *Teodoro 750* (RB); *Warming s.n.* (K, NY). ESPÍRITO SANTO: *Kuhlmann 460* (Z). RIO DE JANEIRO: *Capell RB 82113* (Z); *Cunningham s.n.* (K); *Duarte & Pereira 1749* (MO, Z); *Ginzberger 53* (F); *Glaziou 4081* (G, K, P); *7758* (G, K, P); *13470* (F, K, P); *15223* (BR, G, K, NY, P); *Goes 262* (RB); *Goes & Constantino 435* (BM, MO, RB); *541* (RB); *Goes & Dionisio 992* (RB); *1032* (Z); *Kuhlmann RB 19123* (G, K, P, RB, U); *Lima & Brade 13242* (RB); *Marquete et al. 123* (Z); *Markgraf 10050* (RB); *Martinelli 1327* (Z); *3006* (Z); *Tavares 111* (M); *Vitorio RB 39291* (MO, Z). SÃO PAULO: *Ball s.n.* (K); *Barreto 1727* (F, MO); *Burchell 4246* (BR, K, P); *Edwall RB 119753* (RB); *Frasão RB 86684* (RB); *Hoshimoto 52* (RB); *St. Hilaire 1404* (P); *Wachsmund s.n.* (Z); *Wacket s.n.* (Z). PARANÁ: *Dusen 3410* (NY); *7063* (F, G, MO, NY); *7798* (G, MO); *9094* (MO); *10701* (BR, K, P, Z); *14851* (MO); *14873* (BR, F, K); *15716* (BM, F, K, MO, P, Z); *15911* (NY); *16455* (MO); *Hatschbach 2842* (Z); *12138* (Z); *12473* (Z); *12543* (Z); *13155* (K, Z); *14181* (Z); *17604* (F, MO); *17869* (NY, P, Z); *24222* (NY, Z); *25308* (NY, RB, Z); *26460* (Z); *26591* (Z); *39849* (MO, NY); *41759* (Z); *Hoehne RB 23421* (RB); *Joensson 461a* (BM, G); *1168a* (G); *Kuniyoshi 4091* (Z); *Lindeman 3306* (K, NY, Z); *5288* (K, NY, U); *5350* (F, U); *Pedersen 10994* (MO, NY, Z); *Pereira 5385* (Z); *Reitz & Klein 17430* (NY, P); *Smith et al. 14514* (F). SANTA CATARINA: *Mueller 130* (K); *Smith & Klein 11685* (MO, NY, RB); *13126* (F, K, P, Z); *13162* (NY, P). RIO GRANDE DO SUL: *Rosengurt et al. 9433* (K). PARAGUAY. *Fiebrig 5838* (G, K, P); *Hassler 10926* (G). ARGENTINA. MISIONES: *Ekman 1587* (NY); *Meyer 5573* (U); *Pedersen 11931* (U, Z); *Schwarz 4215* (MO). ENTRE RIOS: *Troncoso 1379* (F, MO).

The type specimen of *Echites isthmica*, which was published in Vellozo's *Flora Fluminensis* (1829) was lost. Therefore, the type of the species becomes the plate in the *Flora Fluminensis*. In the case of *Echites isthmica* the plate is, at best, inadequate, and it is not without some apprehension that I say that *Condyllocarpon rauwolfiae* is conspecific with *C. isthmicum*. However, the plant depicted in plate 39 of the *Flora Fluminensis* (1831) clearly has three leaves per node.

This, together with the fact that the specimen was collected in Rio de Janeiro, near Santa Cruz, almost certainly make it the same species as the type specimen of *C. rauwolfiae*.

The two varieties of *C. rauwolfiae*, *acuminata* and *tomentosa*, are not recognized in *C. isthmicum*. These varieties were circumscribed by Mueller-Argovienensis (1860) by leaf shape and the indumentum of the lower leaf surface, both of which show considerable variability, not only among individuals, but also from the same individual. There may be a two- or three-fold difference in leaf size, depending upon which part of the liana was used for the specimen, as well as upon the maturity of the leaves. In addition, there is a negative correlation between leaf size and latitude, from Ceará at about 5°S, to Rio Grande do Sul at about 27°S.

Condylocarpon isthmicum is similar to *C. intermedium* and *C. glabrum* in having the lorate, red-brown streaked petal appendages and glabrous, articulated fruit.

6. *Condylocarpon myrtifolium* (Miq.) Muell.-Arg. in Martius Fl. Bras. 6(1): 65. 1860.—*Hortsmannia myrtifolia* Miq., Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem. ser. 2, 7: 167. 1851. TYPE: Suriname, without exact locality, *Hostmann 1196* (flowering) (U, lectotype; F, G, GOET, K, MO, NY, P, isolecotypes; F, photos of isolecotypes at G and P, NY, photo of isolecotype at G); 462 (flowering) (P, U, paralectotypes). One of the syntypes is here designated as a lectotype, because a holotype was not designated by Miquel.—Fig. 8E–I.

Slender, woody *lianas*; branches reddish brown, densely lenticellate, puberulous to glabrous, becoming silvery grey and glabrous with age. *Leaves* opposite, oblong-elliptic, membranous, 6.0–10.0 cm long, 2.0–3.5 cm broad, shortly caudate at apex, acumens 1.0 cm long, obtuse to rounded at base, glossy, glabrous on the upper surface, paler, and glabrous on the lower surface, margins plane; secondary veins 11–13 pairs, prominent on the upper surface, with numerous equally prominent inter-secondary veins diverging from the mid-vein, curving and anastomosing with sub-prominent, oblique tertiary venation or occasionally connecting with marginal collective vein. Mid-vein canaliculate on the upper surface, canal puberulous to glabrous, prominent on the lower

surface; petioles 2.0–4.0 mm long, glabrous, canaliculate for about half this length. *Inflorescence* a short, very congested thyrs, glabrous or puberulous in younger branches; bracteoles ovate-triangular, puberulous, golden-brown, ciliate. *Flowers* 3.0–3.5 mm long, subsessile or with pedicels ca. 1.0 mm long; calyx puberulous to pubescent, lower portion darkened by reddish brown markings, lobes pale gold, ovate, apex acute, ciliate; corolla salverform, greenish white to creamy yellow, darker near the base; tube 2.0 mm long, 6.0 mm broad, minutely puberulous, constricted at the base, ca. 1.5 mm broad at the throat; lobes 1.0 mm long, 0.6 mm broad, shortly auriculate, ascending and slightly spreading, without lorate appendages or red-brown markings; stamens lanceolate, inserted at mid-tube; ovary conical, 0.3 mm long, darker than style; style 0.3 mm long, topped by an orbicular style-head; ovules four or five per carpel, biserially arranged. *Fruit* consisting of only one carpel (the second degenerating during development), a pendulous one-seeded, flattened, ellipsoidal disc with an apical notch, 4.0–5.0 cm long, 1.5–2.0 cm broad, greenish brown, leathery, with lateral veins diverging from the canaliculate central suture; seed area longitudinally striate, raised on the abaxial surface.

Distribution: Non-inundated forest in Suriname, Venezuela, and Amazonia (Fig. 5).

Specimens examined. VENEZUELA. DELTA AMACURO: *Bond 218* (NY). GUYANA. *De La Cruz 2850* (NY); *For. Dept. Br. Gui. 4146* (K, NY, U); *im Thurn s.n.* (K, P); *Jenman 88* (P); 243 (NY, P); *Tutin 162* (BM, RB, U). SURINAME. *Focke 958* (U); *Gonggrijp 120* (U); *Kegel 1009* (GOET); *Stahel & Gonggrijp 3000* (U); *Went 551* (U); *Wullschlaegel 1654* (BR). BRAZIL. PARÁ: *Black 48-3006* (RB); *Ducke 7382* (RB, U); *RB 15816* (RB); *RB 21592* (RB); *RB 21618* (RB); *RB 21620* (RB). TERR. RONDÔNIA: *Kuhlmann RB 21866* (RB, U); *Maguire et al. 56763* (F, NY, Z). BOLIVIA. PANDO: *Prance et al. 8654* (F, NY, P, U, Z); *Rusby 2391* (F, G, K, NY).

This species is easily recognized by the oblong, caudate-tipped leaves with numerous inter-secondary veins, and glossy upper surface, and the one-carpellate, inarticulated fruit.

7. *Condylocarpon pubiflorum* Muell.-Arg. in Martius Fl. Bras. 6(1): 67. 1860. TYPE: Brazil, Amazonas, mouth of Río Negro, *Spruce 1564* (flowering) (BR, lectotype; F, G, GOET, K, M, NY, P, isolecotypes; F, NY, photo of isolecotype at B that was destroyed in 1943).—Fig. 9.

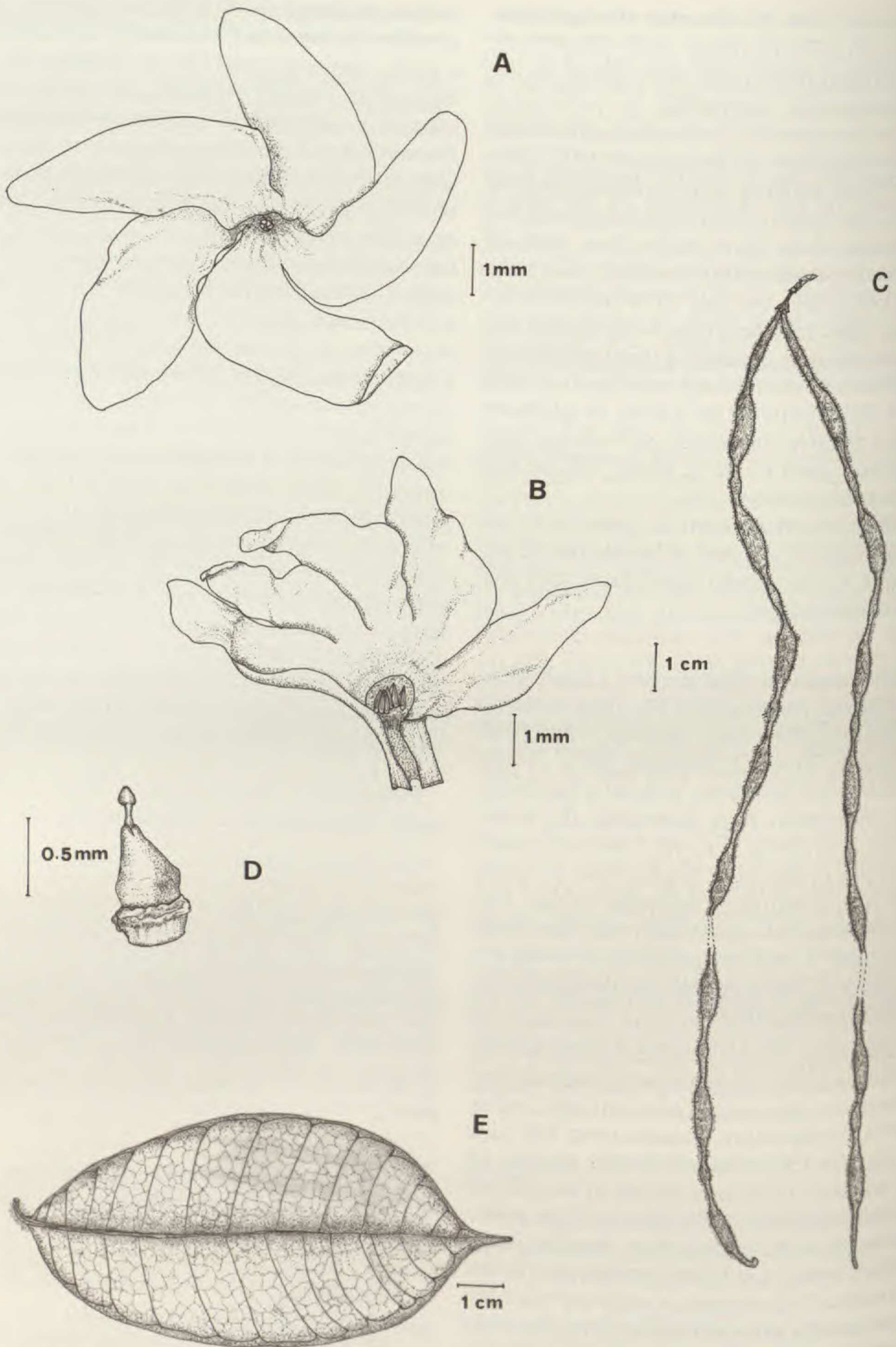


FIGURE 9. *Condyllocarpon pubiflorum*: A, corolla, top view; B, opened corolla, side view; C, fruit; D, gynoecium; E, leaf, upper surface.

Condylocarpon ciliatum Muell.-Arg. in Martius Fl. Bras. 6(1): 66. 1860. TYPE: Amazonas, near Panurê [Ipanôre], Rio Uaupês, Spruce 2475 (flowering) (BR, lectotype; BM, G, K, NY, P, isoelectotypes; F, photo of isoelectotype at B that was destroyed in 1943).

Condylocarpon hirtellum Ducke, Trop. Woods 76: 28. 1943. TYPE: Brazil, Amazonas, Esperança, mouth of Rio Javari, Ducke 1171 (fruiting) (MG, holotype, not seen; NY, isotype).

Large, high-climbing, woody *lianas*; branches terete, reddish brown, somewhat blackened at nodes, golden verrucose or lenticellate, with a sparse indumentum of golden-brown hirsute hairs that is denser at the nodes. Leaves opposite, elliptic to oblong-elliptic, membranous, 6.5–15.0 cm long, 2.5–5.0 cm broad, narrowly acuminate to shortly caudate at apex, acumen 5.0–10.0 mm long, acute to rounded at the base, upper surface glossy, glabrous or with a very sparse scattering of golden-brown hirsute hairs, lower surface paler, glabrous or sparsely golden-brown tomentose, margins revolute; secondary veins 9–15 pairs, slightly impressed on upper surface, prominent and sparsely tomentose on the lower surface; midvein canaliculate on the upper surface, prominent on the lower surface, tomentose to velutinous on both surfaces; petioles 2.0–6.0 mm long, canaliculate, darkened, golden-brown tomentose to hirsute. *Inflorescence* a terminal thyrse, golden-brown puberulous to velutinous; bracteoles triangular, golden to ochre, puberulous to tomentose, persistent, congested and imbricate. *Flowers* 4.0–5.0 mm long, 6.0–9.0 mm broad, subsessile or with glabrous pedicels up to 2.0 mm long; calyx glabrous, lobes ovate, membranous, ciliate; corolla white to creamy yellow, salverform, tube 1.5–2.0 mm long, base constricted, throat ca. 1.0 mm broad, with an annular constriction, lobes spreading, 2.0–5.0 mm long, 1.0–2.0 mm broad, with neither lorate appendages nor red-brown markings. Stamens lanceolate, inserted near top of tube; ovary conical, ca. 0.8 mm long, style 0.3 mm long; style-head turbinate; ovules ca. 16 per carpel, arranged in four or five rows. *Fruit* apocarpous, densely golden tomentose, composed of two woody carpels, each indistinctly articulated into several (up to 16), one-seeded, indehiscent cylindrical segments, each segment 2.0–2.5 cm long, 2.0–3.5 mm broad.

Distribution: Non-inundated or periodically inundated forests in central and western Amazonia (Fig. 7).

Specimens seen. COLOMBIA, PUTUMAYO: Cuatrecasas 10823 (F). AMAZONAS: Schultes 6677 (US). VENEZUELA.

AMAZONAS: Liesner 3603 (MO); Maguire et al. 36752 (F, MO, NY); Morillo & Hasegawa 5165 (F). PERU. LORETO: Gentry 21821 (F, MO, Z); Revilla 321 (F, MO, Z); 1820 (MO); Williams 2011 (F); 3770 (F). BRAZIL. AMAZONAS: Ducke RB 22434 (G, P, RB, U); RB 23938 (RB, U); Fróes 21195 (NY); Krukoff 6760 (NY); 8265 (NY); Martius (M); Spruce 3417 (K).

The nearest relative of *C. pubiflorum* is *C. amazonicum*. The two species most closely resemble each other in the westernmost part of their ranges in Amazonian Peru, Colombia, and Venezuela. Without mature flowers or fruit, specimens of these two species from this region can be very difficult to distinguish from each other.

NUMERICAL LIST OF TAXA

1. *Condylocarpon amazonicum* (Mgf.) Ducke
2. *Condylocarpon glabrum* Muell.-Arg.
3. *Condylocarpon guyanense* Desf.
4. *Condylocarpon intermedium* Muell.-Arg.
 - a. subsp. *intermedium*
 - b. subsp. *laxum* (Muell.-Arg.) Fallen
5. *Condylocarpon isthmicum* (Vell.) A. DC.
6. *Condylocarpon myrtifolium* (Miq.) Muell.-Arg.
7. *Condylocarpon pubiflorum* Muell.-Arg.

LIST OF EXSICCATAE

The figures in parentheses refer to the species number as given above in the numerical list of taxa. Collection year follows s.n., when available.

Anderson, W. R., 7822 (5); 8265 (5)
 Baker, R. E. D., TRIN 14568 (4a)
 Ball, J., s.n., 1882 (5)
 Barreto, M., 914 (5); 1727 (5); 5177 (5)
 Beckett, J. E., s.n., 1906 (4a)
 Belém, R. P. et al., 24 (5)
 Black, G. A., 48-3006 (6)
 Blanchet, J. S., 1576 (4a)
 Bond, F. E. et al., 218 (6)
 Brade, A. C., 11055 (4a)
 Breteler, F. J., 4753 (1)
 Burchell, W. J., 3513 (5); 4246 (5); 5975 (5)
 Capell, P., RB 82113 (5)
 Chagas, J., 416 (1)
 Chauso, S. et al., 78 (5)
 Cid, C. et al., 825 (1); 925 (1)
 Cordeiro, M. R. et al., 136 (1); 594 (1); 828 (1)
 Crueger, H., s.n., 1860 (4a)
 Cuatrecasas, J., 10823 (7)
 Cunningham, A., s.n., 1867 (5)
 De La Cruz, J. S., 2850 (6); 4117 (4a)
 Duarte, A. P. et al., 1749 (5); 3538 (5); 9900 (5); 10185 (5)
 Ducke, A., 353 (1); 699 (1); 974 (1); 1171 (7); 1172 (1); 2344 (1); 7382 (6); RB 15816 (6); RB 17480 (1); RB 21592 (6); RB 21618 (6); RB 21620 (6); RB 21697 (1); RB 22434 (7); RB 23876 (1); RB 23938 (7)

- Dusen, P. K. H., 3410 (5); 7063 (5); 7798 (5); 9094 (5); 10701 (5); 14851 (5); 14873 (5); 15716 (5); 15911 (5); 16455 (5)
- Edwall, G., RB 119753 (5)
- Ekman, E. L., 1587 (5)
- Engler, 65 (5); s.n., 1864 (5)
- Eugenio, J., 980 (5); 981 (5)
- Fiebrig, K., 5838 (5)
- Finlay, Mrs. G. R., 2767 (4a)
- Focke, H. C., 958 (6)
- Fontella et al., 1118 (5)
- Forero, E. et al., 6317 (1)
- For. Dept. Br. Gui. (Guyana), 83 (3); 315 (4a); 4146 (6); 5066 (4a); 5193 (4a)
- Frasão, A., RB 86684 (5)
- Frões, R. L., 21195 (7); 30423 (1)
- Gardner, G., 5074 (5)
- Gaudichaud, C., 366 (5); s.n. (4b)
- Gentry, A. H. et al., 21821 (7)
- Ginzberger, A. et al., 53 (5)
- Glaziou, A. F. M., 4081 (5); 7758 (5); 7886 (5); 13470 (5); 15223 (5); 21730 (5)
- Goés, O. C. et al., 262 (5); 435 (5); 541 (5); 992 (5); 1032 (5)
- Gonggrijp, J. W., 120 (6)
- Graham, Bro. Wm., s.n. (5)
- Hanbury, G., 2 (5); 4 (5); s.n. (5); s.n., 1866 (5); s.n., 1868 (5)
- Harley, R. M., 19907 (5)
- Hassler, E., 10926 (5)
- Hatschbach, G., 2842 (5); 12138 (5); 12473 (5); 12543 (5); 13155 (5); 14181 (5); 17604 (5); 17869 (5); 24222 (5); 25308 (5); 26460 (5); 26591 (5); 39849 (5); 41759 (5)
- Heringer, E. P., 9189 (5); 9915 (5)
- Heyde et al., 65 (1); 190 (1)
- Hitchcock, A. S., 17519 (4a)
- Hoehne, F. C., RB 23421 (5); RB 28439 (5)
- Hoshimoto, A., 52 (5)
- Hostmann, W. R. et al., 264 (6); 1196 (6)
- Im Thurn, E., s.n., 1879 (6)
- Irwin, H. S. et al., 8339 (5); 9539 (5); 11141 (5); 11420 (5); 15357 (5); 15657 (5); 15913 (5); 18542 (5); 20764 (5); 27417 (5); 31786 (5); 48275 (3); 66022 (1)
- Jenman, G. S., 88 (6); 243 (6); 6173 (4a)
- Joensson, G., 461a (5); 1168a (5)
- Kegel, H., 1009 (6)
- Krieger, P. L. et al., 10846 (5); 11373 (5)
- Krukoff, B. A., 6760 (7); 8007 (1); 8265 (7)
- Kuhlmann, J. G., 460 (5); RB 3788 (4b); 6411 (4a); RB 19123 (5); RB 21866 (6); RB 39290 (4b)
- Kuniyoshi, Y. S., 4091 (5)
- Lescure, 531 (3)
- Lhotsky, J., s.n. (5)
- Liesner, R., 3603 (7)
- Lima, S. et al., 13242 (5)
- Lindberg, G. A., 192 (5)
- Lindeman, J. C., 3306 (5); 5288 (5); 5350 (5)
- Long, L. E., 132 (4a)
- Magalhães, M., 1226 (5)
- Maguire, B. et al., 22890 (3); 36752 (7); 56763 (6)
- Manso, A. L. P. da Silva, 335 (5); s.n., 1834 (5)
- Markgraf, F., 10050 (5)
- Marquete, N. et al., 123 (5)
- Martin, J., s.n. (3)
- Martinelli, G. et al., 1327 (5); 3006 (5); 4184 (4a); 8450 (4a)
- Martius, K. F. P. von, s.n., 1819 (5); s.n. (7)
- Mello, M., s.n. (4a)
- Mexia, Y., 4680 (5)
- Meyer, T., 5573 (5)
- Miers, J., 4019 (4b); 8086 (4b)
- Moliná, R. A., 2081 (4a)
- Mori, S. et al., 12327 (5)
- Morillo, G., 5165 (7)
- Mosén, C. W. H., 621 (5); 3653 (5)
- Mueller, F., 130 (5)
- Oldeman, R. A. A., B1125 (3)
- Oliveira, E., 3610 (1)
- Pabst, G., 9065 (5)
- Peckott, T., 350 (5)
- Pedersen, T. M., 10994 (5); 11931 (5)
- Pereira, E., 5385 (5)
- Pinheiro, R. S., 2147 (4a)
- Pires, J. M. et al., 50683 (3); 58060 (5)
- Pohl, J. E., 651 (5)
- Prance, G. T. et al., 5627 (1); 8654 (6); 14230 (1); 14708 (1)
- Prévost, M. F., 514 (3)
- Raddi, G., s.n. (4b)
- Regnell, A. G., II-136 (5)
- Reitz, P. R. et al., 17430 (5)
- Revilla, J., 321 (7); 1280 (7); 1820 (7)
- Riedel, L., 85 (5); s.n. (4b)
- Rodrigues, W. A. et al., 1303 (1)
- Rosengurt et al., 9433 (5)
- Roth, L., 1736 (5)
- Rusby, H. H., 2391 (6); 2599 (1)
- Saint Hilaire, A., 172 (5); 1227 (5); 1404 (5); s.n., 1816-1821 (4a)
- Sastre, C., 4701 (3); 5470 (3); 5906 (3)
- Schomburgk, R., 785 (4a); 1426 (4a)
- Schott, H. W., 5478 (4b); 5479 (5)
- Schwacke, C. A., 3100 (4a)
- Schwarz, G. J., 4215 (5)
- Sellow, F., 45 (5); 304 (2); 571 (4a); s.n., 1815-1817 (4a); s.n. (5)
- Silva, N. T., 936 (1)
- Smith, L. B. et al., 11685 (5); 13126 (5); 13162 (5); 14514 (5)
- Spruce, R., 1564 (7); 2475 (7); 3417 (7)
- Stahel, G. et al., 3000 (6)
- Steyermark, J. et al., 114448 (4a)
- Tavares, J., 111 (5)
- Teodoro, T., 750 (5)
- Troncoso, N. S., 1379 (5)
- Tutin, T. G., 162 (6)
- Tweedie, J., s.n. (5)
- Vitório, RB 39291 (5)
- Wachsmund, A., s.n., 1902 (5)
- Wacket, M., s.n., 1902 (5)
- Ward, R. et al., 8729 (4a)
- Warming, J. E. B., s.n., 1864 (5)
- Went, F. A. F. C., 551 (6)
- Widgren, J. F., 64 (5); 192 (5); 1236 (5)
- Williams, L., 2011 (7); 3770 (7)
- Wulfschlaegel, H. R., 1654 (6)

LITERATURE CITED

- DE CANDOLLE, A. 1844. Apocynaceae, in *Prodromus systematis naturalis regni vegetabilis* 8: 317-489.
- DESFONTAINES, M. 1822. Description d'un nouveau genre. *Mém. Mus. Hist. Nat.* 8: 119-121.

- DUCKE, A. 1943. New forest trees and climbers of the Brazilian Amazon. *Trop. Woods* 76: 15-32.
- ERDTMAN, G. 1952. Pollen morphology and plant taxonomy. Angiosperms. Almqvist & Wiksell, Stockholm. 539 pp.
- FALLEN, M. E. 1983. A systematic revision of *Anechites* (Apocynaceae). *Brittonia* 35: (in press).
- MARKGRAF, F. 1926. Neue Apocynaceen aus Suedamerika II. *Notizbl. Bot. Gart. Dahlem* 9: 959-963.
- . 1930. Neue Apocynaceen aus Suedamerika III. *Notizbl. Bot. Gart. Dahlem* 10: 1033-1039.
- . 1980. Algumas Apocináceas novas do Brasil. *Bradea* 3: 77-87.
- MIERS, J. 1878. On the Apocynaceae of South America. Wms. & Norgate, Edinburgh. 277 pp.
- MIQUEL, F. A. G. 1851. *Stirpes surinamenses*. *Natuurk. Verh. Holl. Maatsch. Wetensch. Haarlem*, ser. 2, 7: 167.
- MUELLER-ARGOVIENSIS, J. 1860. Apocynaceae, in Martius, *Fl. Bras.* 6(1): 63-67.
- PICHON, M. 1948a. Classification des Apocynacées. I. Carissées et Ambélaniées. *Mém. Mus. Natl. Hist. Nat.* 24: 111-181.
- . 1948b. Classification des Apocynacées. IX. Rauwolfiées, Alstoniées, Allamandées et Tabernaémontanoidées. *Mém. Mus. Natl. Hist. Nat.* 27: 153-252.
- . 1951. Classification des Apocynacées. XXV. Echitoidées et suppl. aux Plumérioidées. *Mém. Mus. Natl. Hist. Nat., Sér. B, Bot.* 1: 1-174.
- SCHICK, B. 1980. Untersuchungen über die Biotechnik der Apocynaceenblüte. I. Morphologie und Funktion des Narbenkopfes. *Flora* 170: 394-432.
- SCHUMANN, K. 1897. Apocynaceae in Engler, A. and K. Prantl, *Die natürlichen Pflanzenfamilien* 4(2): 109-189. Leipzig.
- STEBBINS, G. L. 1971. Adaptive radiation of reproductive characteristics in angiosperms, II. Seeds and seedlings. *Annual Rev. Ecol. Syst.* 2: 237-260.
- VELLOZO, J. M. DA C. "1825 [1829]." Apocynaceae, in *Flora Fluminensis* 3: 112; *Icones* 3, t. 39 "1827 [1831]." Text and plate reprinted in *Arq. Mus. Nac. Rio de Janeiro* 5: 106. 1881.